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Docket 85354NRS
Customer No. 01333

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Robert M. Guidash

IMAGE SENSOR WITH CHARGE
BINNING AND DUAL CHANNEL
READOUT

Serial No. 10/620,060

Filed 15 July 2003

Commissioner for Patents
P.O. Box 1450
Alexandria, VA. 22313-1450

Group Art Unit: 2622
Confirmation No. 7686
Examiner: Chriss S. Yoder III

Pre-Appeal Brief Request For Review

Sir:

Applicant requests a review of the final rejection in the above-identified application. No amendments are being filed with this request. The request is being filed with a Notice of Appeal.

This review is requested for the reasons stated on the attached pages.

102(b) Rejection

Independent claims 22 and 37 recite “a plurality of charge to voltage conversion regions; wherein at least two adjacent light receiving elements share a charge to voltage conversion region; wherein charge of adjacent light receiving elements is combined in the shared charge to voltage conversion region.” The Examiner argues Fossum teaches this aspect of the claimed invention because Fossum “discloses the use of multiresolution circuitry, and that this multiresolution circuitry has been interpreted to include the charge-to-voltage conversion regions. The charge from each pixel is sent to a charge-to-voltage conversion region within the multiresolution circuitry (the combination of 702 and 704 is considered to be the charge-to-voltage conversion regions), and depending on the resolution to be output, the charge-to-voltage conversion regions can be switchably shared to average adjacent pixels” (page 2 of final office action).

Applicant notes Fossum discloses a charge-to-voltage conversion region in floating diffusion 40, an element included within each pixel cell 10 (see col. 6, lines 1-4). After the integration period, photo-generated charge is transferred from the photogate 12 to the floating diffusion 40, where the potential of the floating diffusion 40 is sensed by the source follower amplifier transistor 55. The signal read from the source follower amplifier transistor 55 is a voltage signal representative of the amount of charge generated by the photogate 12 (col. 6, lines 32-49). Because each pixel cell 10 includes a floating diffusion 40 that is connected to a source follower amplifier transistor 55, the signals read out of the pixels in a CMOS APS sensor by the readout circuitry are voltage signals.

Regions 702 and 704 are included in Fossum's column parallel embodiment, where the multiresolution circuitry 604 is connected to the bottom of the columns in the array (col. 11, lines 3-13). Regions 702 and 704 are two capacitor banks that are interconnected through a set of programmable switches to perform signal averaging (col. 12, lines 21-24). The first bank 702 corresponds to the column averaging section 608 shown in figure 7. The second bank 704 corresponds to the row averaging section 610 shown in figure 7 (col. 12, lines 24-27). These two capacitor banks allow the voltage signals read from blocks of pixels in the image sensor (e.g., 3 rows of pixels form one block) to be averaged together to reduce the resolution of an image (see col. 10, lines 12-41; col. 12, line 36 to col. 13, line 11).

When evaluating a claim, the claim as a whole must be considered, and as such, every limitation in the claim must be considered. MPEP § 2106. Applicant submits the two capacitor banks do not teach or suggest charge-to-voltage conversion regions since the capacitor banks store the voltages read from the pixels. Independent claims 22 and 37 expressly state the "charge of adjacent light receiving elements is combined in the shared charge to voltage conversion region."

And as discussed earlier, the floating diffusion 40 in each pixel cell 10 discloses a charge-to-voltage conversion region. Fossum discusses the floating diffusions in several sections of the patent, including lines 42-52 in column 6, line 63 in column 6 to line 28 in column 7, line 53 in column 8 to line 11 in column 9, lines 34-35 in column 9, lines 1-7 in column 10, lines 59-66 in column 13, and in lines 33-40 in column 16. Nothing found in Fossum teaches or suggests two adjacent photogates sharing a single floating diffusion. In fact, Fossum expressly states each pixel in the array 602 is accessed "through conventional row and column selection circuitry 606" (col. col. 11, lines 14-16; see also col. 10, lines 2-4). Since conventional row and column selection circuitry is used, the floating diffusions 40 are not shared, since shared floating diffusions require specialized row and column selection circuitry (see e.g., Applicant's figures 7-8 and corresponding descriptions).

In order for a reference to anticipate an invention, each and every element of the claimed invention must be found in a single reference. "The identical invention must be shown in as complete detail as is contained in the ... claim." MPEP § 2131. Applicant respectfully submits Fossum does not teach "a plurality of charge to voltage conversion regions; wherein at least two adjacent light receiving elements share a charge to voltage conversion region; wherein charge of adjacent light receiving elements is combined in the shared charge to voltage conversion region." Therefore, for at least the following reason, Fossum does not anticipate independent claims 22 and 37.

"Claims in dependent form shall be construed to include all the limitations of the claim incorporated by reference into the dependent claim." 37 CFR § 1.75. Claims 23-25 depend from and include all of the limitations of independent claim 22, while claims 38-40 depend from and include all of the limitations of independent claim 37. For at least the reasons discussed above, Fossum does not anticipate independent

claims 22 and 37. Accordingly, dependent claims 23-25 and 38-40 are also not anticipated by Fossum.

103(a) Rejections

Nam and Tu

Independent claims 5 and 8 recite "a color difference readout signal is output when a reset signal for at least one column circuit is obtained by sampling the signal of one color and the light signal level for that column circuit is obtained by sampling the signal of a different color." The Examiner notes Nam does not teach this limitation, but argues Tu discloses this aspect of the claimed invention in paragraphs [0049] - [0051]. In particular, the Examiner argues the reset from one pixel *Vrst1* and the image signal from another pixel *Vsig2* are used to output a difference signal (page 6 of final office action).

Applicant respectfully submits Tu does not teach or suggest obtaining a color difference readout signal as claimed in Applicant's claims 5 and 8. Paragraphs [0049] - [0051] are describing how to use the shared column amplifier 434 for the embodiment shown in figure 9. The figure 9 embodiment includes two initial storage area capacitors 918, 920 that are capable of receiving and storing two simultaneously received signals from the column lines 902, 904, the shared amplifier 434, and two secondary storage area capacitors 460, 462 that store the amplified sample and reset signals (paragraph [0042]). Tu expressly states in this paragraph that since "*Vrst* of the first pixel and *Vrst* of the second desired pixel are substantially equivalent, *Vrst* of the first desired pixel coupled to column line 902 can be used for the *Vrst* of the second desired pixel coupled to column line 904 and visa versa" (emphasis added).

Thus, paragraphs [0049] - [0051] are describing how to obtain a pixel output from a single pixel using a shared amplifier. The reset value is sampled and stored in an initial storage capacitor, amplified, and then stored in a secondary capacitor. The signal value is sampled and stored in another initial capacitor, amplified, and then stored in another secondary capacitor. Both of these signals are then transferred from the secondary capacitors to the output stage 354.

Based on the foregoing, Applicant submits Nam and Tu do not teach or suggest outputting a color difference readout signal "when a reset signal for at least one column circuit is obtained by sampling the signal of one color and the light signal level for that column circuit is obtained by sampling the signal of a different color." Therefore, for

at least the following reason, Applicant's independent claims 5 and 8 are not obvious in view of the combination of Nam and Tu.

"If an independent claim is not rendered obvious by prior art, then any claim depending from the independent claim is not obvious." In re Fine, 5 USPQ2d 1596 (Fed. Cir. 1988) (see also M.P.E.P. § 2143.03). Claim 6 depends from claim 5 while claim 9 depends from claim 8. Since the combination of Nam and Tu does not render independent claims 5 and 8 obvious, dependent claims 6 and 9 are also not obvious in view of Nam and Tu.

Nam, Tu, and Fossum

Applicant's arguments with respect to Nam and Tu apply to this rejection as well. And Fossum does not make up for the deficiencies of Nam and Tu. Therefore, Applicant submits independent claims 5 and 8 are not obvious in view of the combination of Nam, Tu, and Fossum. Claims 7 and 10 dependent from independent claims 5 and 8, respectively. "If an independent claim is not rendered obvious by prior art, then any claim depending from the independent claim is not obvious." In re Fine, 5 USPQ2d 1596 (Fed. Cir. 1988) (see also M.P.E.P. § 2143.03). Since the combination of Nam, Tu, and Fossum does not render independent claims 5 and 8 obvious, dependent claims 7 and 10 are also not obvious in view of Nam, Tu, and Fossum.

Berger and Guidash

Independent claims 11 and 26 recite "at least two signal storage banks comprised of individual signal storage elements; each of the at least two storage banks having enough individual storage elements to store the signals from at least one row of light receiving elements in the array, wherein multiple samples of each signal from at least one row of light receiving elements are concurrently stored in different individual signal storage elements." The Examiner notes Berger does not teach this limitation, but argues Guidash discloses this aspect of the claimed invention by teaching "that concurrently storing multiple samples of each signal from at least one row of light receiving elements in different individual signal storage elements within a single storage bank is preferred in order to cancel pixel offset noise and extend the dynamic range of the pixel" (page 11 of final office action).

In one embodiment, Guidash teaches a differential readout that stores a floating diffusion signal of a pixel 10 on one capacitor C4, a floating diffusion reset signal of the pixel 10 on another capacitor C5, and a photodetector signal level of the pixel 10 on

a third capacitor C6 (col. 4, lines 40-65 and figure 1b). Another embodiment shown in figure 5 "envision[s] that a differential readout be employed to read the floating diffusion 28 signal level of color filter 1 on capacitor C4 using the reset level on capacitor C5 as a reference input into the differential amplifier 31. A second differential readout for the photodetector 22 signal level of color filter 2 on capacitor C6 via differential amplifier 32 with the reset level of capacitor C5 again as the reference input." (col. 6, lines 34-43).

Nothing found in Guidash and Berger teaches or suggests "multiple samples of each signal from at least one row of light receiving elements are concurrently stored in different individual signal storage elements." Therefore, independent claims 11 and 26 are not obvious in view of the combination. And since claims 12-18 and 20 depend from independent claim 11 while claims 27-33 and 35 from independent claim 26, dependent claims 12-18, 20, 27-33, and 35 are also not obvious in view of Berger and Guidash.

Berger, Guidash, and Fossum

Applicant's arguments with respect to Berger and Guidash apply to this rejection as well. And Fossum does not make up for the deficiencies of Berger and Guidash. Therefore, Applicant submits independent claims 11 and 26 are not obvious in view of the combination of Berger, Guidash, and Fossum. Accordingly, dependent claims 19, 21, 34 and 36 are also not obvious in view of Berger, Guidash, and Fossum.

In light of the above remarks, Applicant respectfully requests the rejections under 35 U.S.C. § 102(b) and 103(a) be reversed and claims 5-40 be allowed.

Respectfully submitted,


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If the Examiner is unable to reach the Applicant(s) Attorney at the telephone number provided, the Examiner is requested to communicate with Eastman Kodak Company Patent Operations at (585) 477-4656.